

UNITED STATES PATENT OFFICE.

ARCHIBALD H. COPLAN, OF OTTAWA, ONTARIO, CANADA.

STEEL AND PROCESS FOR PRODUCING SAME.

No Drawing.

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To all whom it may concern:

Be it known that I, ARCHIBALD H. COPLAN, a citizen of the Dominion of Canada, residing at Ottawa, in the county of Carleton and Province of Ontario, have invented certain new and useful Improvements in Steel and Processes for Producing Same, of which the following is a specification.

This invention relates more particularly to a method or process of treating certain alloy steels to produce a product which may be readily cast into any desired form and which will resist strain and prevent warping when exposed to heat and acids.

The main or characteristic features of this invention relate to the economical production of low carbon nickel-chrome steel which may be cast in ordinary sand molds. The product is suitable for a variety of uses, but is particularly adapted for use in the manufacture of castings where wear and resistance to heat and acids are important factors. Owing to the reduction in the cost of production of such high grade steel by my process, this product may be profitably used for the manufacture of furnace grate bars and I consider this a special feature of my invention.

The high temperature at which the product must be heated during the making has heretofore eaten the furnace linings and, therefore, it has been exceedingly hard to produce the steel as hereinafter mentioned.

I remove the oxygen or other gases from the alloy prior to pouring.

In the operation of my process I prefer to use an electric furnace of any desired construction and preferably provided with a lining of chrome brick up to the slag line.

When the furnace is heated to a desired temperature of about 3500° Fahrenheit, steel scrap, preferably of low carbon content, is charged therein and melted. The carbon is then practically all removed from the charge by the use of preferably hematite iron ore.

The silicon from the steel scrap is practically all removed and the sulphur and phosphorus reduced to approximately 0.03% respectively.

The slag is then removed and the practically carbonless steel is further treated as hereinafter described.

A ferro-chrome alloy of relatively high carbon content may be cheaply produced or

bought at low cost, I preferably use an alloy with about 7% carbon content and heat it with equal proportions by weight of iron ore or oxidized steel turnings in a furnace for about 24 hours at a temperature of approximately 2500° Fahrenheit. The carbon content of this alloy is in this way reduced to about 3%.

I now add about 2% of this ferro-chrome to the steel in the furnace and secure a product containing a very low percentage of carbon, in this particular case about 0.06% carbon. The percentage of ferro-chrome added may, however, vary but the carbon should not exceed from 0.05% to 0.15%. The chromium content of this particular steel is 1.25%, but the chromium may vary between 1.25% and 1.50%. 2% of nickel is now added to the steel.

Much difficulty was encountered in pouring low carbon nickel-chrome or steel into molds, and I have succeeded in overcoming this difficulty by using as a scavenger for removing the gases from the steel 1.5% ferro silicon and 5% of a composition containing 50% aluminum and 50% of ferro-titanium. Owing to the low specific gravity of the aluminum, it is impractical to add it to the steel in powdered form, thus I melt the aluminum and mix with it granular ferro-titanium. This I cast into a pig or ingot. I add the ferro-silicon to the steel and when the temperature in the furnace has been raised to 3500° Fahrenheit, by means of a steel rod, I plunge the aluminum-titanium pig into the steel. By these means, I have been able to completely remove the oxygen and other gases from the steel which may now be poured directly into the sand molds and the castings will be quite free from holes or other defects.

What I claim as new is:

1. The process of producing steel which consists in melting scrap iron in a furnace; substantially completely removing the carbon by the use of an oxidizing slag; adding such proportion of ferro-chrome, the carbon content of which has been reduced to approximately 3%, as will give the steel a carbon content not exceeding 0.15% and a chromium content of 1.25% and adding 2% nickel to the steel, substantially as described.

2. The process of producing low carbon nickel-chrome steel which may be readily cast in sand molds which consists in melting

scrap iron in a furnace, completely removing the carbon by the use of hematite iron ore; removing the slag formed; adding such proportion of ferro-chrome of low carbon content as will give the steel a carbon content of 0.05% to 0.15% and a chromium content of 1.25% adding 2% nickel; purifying the steel by adding a small percentage of ferro-silicon and immersing a small aluminum ferro-titanium ingot in the steel at a temperature of 3500° Fahrenheit just prior to casting as herein described.

3. A low carbon nickel-chrome steel which may be readily cast in sand molds to produce castings which are strong and resistant to corrosion and heat containing approxi-

mately carbon 0.10%; chromium 1.25% and nickel 2%.

4. The process of producing a low carbon nickel-chrome steel which will be readily cast in sand molds containing carbon, chromium and nickel by purifying the steel by adding a small percentage of ferro-silicon and immersing a small aluminum ferro-titanium ingot therein when the charge is at a high temperature.

In testimony whereof, I affix my signature in the presence of two witnesses.

ARCHIBALD H. COPLAN.

Witnesses:

M. McMILLAN,
R. SLONIMSKY.